Docket No.: 216984US0RE

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :

Masaru ISHIHARA et al. : ATTN: APPLICATION DIVISION

REISSUE OF: 6,060,289 :

FILED: HEREWITH :

FOR: MODIFIED BACTERIAL CELLULOSE

DECLARATION UNDER 37 C.F.R. §1.175

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are stated below next to my name. I believe I am the original, first and sole inventor (if only one name is listed below) or an original first and joint inventor (if plural names are listed below) of the subject matter which is described and claimed in the below identified patent:

Patent No.: 6,060,289
Date Patent Issued: May 09, 2000
Title of Invention: Modified Bacterial Cellulose

for which a reissue patent is sought on the invention entitled Modified Bacterial Cellulose, the specification of which is attached hereto as Exhibit 1 and amended in the Preliminary Amendment attached hereto as Exhibit 2.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by the Preliminary Amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. §1.56.

We (I) hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed. The prior foreign application(s) are:

Application	Country	Date/Month/Year	Priority Claimed
8-215332	Japan	26 July 1996	Yes
9-062282	Japan	28 February 1997	Yes

I verily believe the original patent to be wholly or partly inoperative or invalid by reason of a defective specification and drawing, by reason of the patentee claiming more or less than he had the right to claim in the patent, and by reason of other errors.

Errors upon which reissue is based are described as follows:

Although we observed the ribbon-shaped microfibrils by the electron microscope and the atomic force microscope, the electron microscope catches shadow of the microfibrils. On the other hand, the atomic force microscope measures actual figure by moving a probe in contact with a surface to be measured. Then, we considered that the results obtained by the atomic force microscope are accurate, and the width and thickness of the microfibrils were determined based on the results obtained by the atomic force microscope. The end of the probe was rounded having a half diameter of 10 nm. Then, the limit of detection of the atomic force microscope was considered to be 10 nm. This is in the horizontal direction. However, in July, 1999, we learned from the manufacturer of the atomic force microscope

that the microscope has a resolving power of 0.01 nm in the vertical direction, and it is possible to determine a size in the order of 0.01 nm by utilizing the resolving power in the vertical direction which had been recently developed.

We measured the thickness and width of the microfibrils obtained in Examples 1, 2 and 4 again by the recently developed method, and found that the thickness was in the range of 1 to 9 nm, as shown in the attached Exhibit 3.

Moreover, as a result of the change in the thickness of the microfibrils described above, the ratio of the major axis/minor axis is changed as well. The lower limit of this ratio is 250 nm:9 nm = 28:1.0, and the upper limit is 1000 nm:1 nm = 1000:1.0, and with respect to the particular range, the lower limit is 250 nm: 9 nm = 28:1.0 and the upper limit is 700 nm:2.5 nm = 280:1.0.

Based on the errors noted above, I understand that the specification of the above-identified application is amended as described below.

The paragraph at column 1, lines 49-64, is amended as shown below:

> Thus, the present invention provides, bacterial cellulose comprising ribbon-shaped microfibrils having a thickness of <u>1 to 9</u> [10 to 100] nm and a width of 160 to 1000 nm, a method of producing bacterial cellulose which comprises culturing cellulose-producing bacteria which produce the bacterial cellulose extracellularly in a culture medium containing a cell division inhibitor, and recovering the bacterial cellulose produced in the culture medium, and further the present invention provides bacterial cellulose comprising ribbon-shaped microfibrils having a thickness of <u>1 to 9</u> [10 to 100] nm and a width of 50 to 70 nm, and a method of producing bacterial cellulose which comprises culturing

cellulose-producing bacteria which produce the bacterial cellulose extracellularly in a culture medium containing an organic reducing agent, and recovering the bacterial cellulose produced in the culture medium.

The paragraph at column 2, line 63 to column 3, line 6, is amended as shown below:

The bacterial cellulose of the invention comprises ribbon-shaped microfibrils having a minor axis of 1 to 9 [10 to 1000] nm and a major axis of 160 to 1000 nm or 50 to 70 nm. The inventors cultured cellulose producing bacteria (*Acetobacter pasteurianus* FERM BP-4176) in a culture medium without containing cell division inhibitor and organic reducing agent, and the size of the microfibrils of the bacterial cellulose was measured. As a result, the microfibril had a minor axis of 1 to 9 [10 to 100] nm and a major axis of 80 to 150 nm. Accordingly, the bacterial cellulose of the invention is clearly different from conventional bacterial cellulose.

The paragraph at column 3, lines 7-13, is amended as shown below:

The minor axis of microfibrils is 1 to 9 nm [, in general, 55 to 95 nm, occasionally smaller size, e.g., 25 nm,] irrespective of the bacterial cellulose of the invention obtained by culturing in a culture medium containing a cell division inhibitor or an organic reducing agent or conventional bacterial cellulose obtained by culturing in a culture medium not containing cell division inhibitor and organic reducing agent.

The paragraph at column 3, lines 14-28, is amended as shown below:

On the other hand, the major axis of the microfibrils of the bacterial cellulose obtained by culturing in a culture medium containing a cell division inhibitor is, in general, 160 to 700 nm, particularly 170 to 600 nm, occasionally longer size, e.g. 1000 nm. That is, the major axis is considerably greater compared with conventional major axis of 80 to 150 nm. When a culture medium contains a cell division inhibitor, cellulose-producing bacteria are lengthened, and it is observed that a plurality of single chains are adhered to each other to form a bundle. The bundle can be deemed single chain, and accordingly, the major axis becomes considerably longer than conventional one. The ratio of major axis minor axis is about <u>28:1.0 to 1000:1</u> [2.8:1.0 to 8.1:1.0], particularly, <u>28:1.0 to 280:1</u> [3.0:1.0 to 6.0:1.0. In the case of conventional microfibrils, the ratio of major axis/minor axis is 1.6:1.0 to 2.7:1.0.]

The paragraph at column 3, lines 29-35, is amended as shown below:

In the case of the bacterial cellulose obtained by culturing in a culture medium containing an organic reducing agent, the major axis of the microfibrils is, in general, 50 to 70 nm, and it is difficult to discriminate the major axis and the minor axis. It is considered to be caused by shortening of bacterial cell. [The ratio of major axis: minor axis is about 0.9:1.0 to 1.5:1.0, particularly, 1.2:1.0 to 1.5:1.0.]

The paragraph at column 7, lines 6-16, is amended as shown below:

The ribbon-shaped microfibrils produced in NA-added media were observed by the electron microscope and the

atomic force microscope, and found that the major axes (width) was great, e.g. 170 nm, 340 nm, 430 nm, 590 nm, etc. , but the minor axes (thickness) were in the range of 1 to 9 nm, e.g., 2.5 nm, 3 nm, 6 nm, 9 nm [10 to 100 nm, e.g., 25, 30, 60, 90 nm] etc. On the other hand, the ribbon-shaped microfibrils produced in no NA added medium had a major axis (width) of 82 nm, 107 nm, etc and a minor axis (thickness) in the range of 1 to 9 [10 to 100] nm, and significant variation was not observed compared with NA added medium concerning the minor axis.

The paragraph at column 8, lines 38-48, is amended as shown below:

The CP ribbon-shaped microfibrils produced in NA-added media were observed by the electron microscope and the atomic force microscope, and found that the major axes (width) was great, e.g. 160 nm, 330 nm, 450 nm, 570 nm, 690 nm, etc., but the minor axes (thickness) were in the range of 1 to 9 [10 to 100] nm. On the other hand, the ribbon-shaped microfibrils produced in no CP added medium had a major axis (width) of 82 nm, 107 nm, etc and a minor axis (thickness) in the range of 1 to 9 nm, and significant variation was not observed compared with CP added medium concerning the minor axis.

The paragraph at column 9, lines 39-50, is amended as shown below:

The DTT ribbon-shaped microfibrils produced in NA-added media were observed by the electron microscope and the atomic force microscope, and found that the major axes (width) was small, e.g. 56 nm, 57 nm, 70 nm, etc., but the minor axes (thickness) were in the range of 1 to 9 [10 to 100]

nm. On the other hand, the ribbon-shaped microfibrils produced in n DTT added medium had a major axis (width) of 82 nm, 107 nm, etc and a minor axis (thickness) in the range of 1 to 9 [10 to 100] nm, and significant variation was not observed compared with DTT added medium concerning the minor axis.

The Abstract is replaced with the substitute Abstract shown below:

This invention provides a bacterial cellulose comprising ribbon-shaped microfibrils having a thickness of 1 to 9 nm and a width of 160 to 1000 nm or a bacterial cellulose comprising ribbon-shaped microfibrils having a thickness of 1 to 9 nm and a width of 50 to 70 nm. The former bacterial cellulose can be produced by culturing cellulose-producing bacteria in a culture medium containing a cell division inhibitor, and the latter can be produced by culturing the bacterium in a culture medium containing an organic reducing agent. The bacterial cellulose is modified from conventional bacterial cellulose in the major axis, and is improved in Young's modulus, etc.

Figure 1 of the patent is replaced with the substitute Figure 1 submitted with the Preliminary Amendment attached hereto.

Figure 2 of the patent is replaced with the substitute Figure 2 submitted with the Preliminary Amendment attached hereto.

Figure 3 of the patent is replaced with the substitute Figure 3 submitted with the Preliminary Amendment attached hereto.

Claims Claims 4, 5 and 6 of the patent are cancelled.

The claims are amended in the Preliminary Amendment attached hereto as shown below:

1. (Amended) A bacterial cellulose comprising microfibrils having a thickness of 1 to 9 [10 to 100] nm and a width of 250 to 1000 nm.

2. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a width of 250 to 700 nm.

3. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a width of 250 to 600 nm.

15. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a width of 430 to 1000 nm.

16. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a width of 590 to 1000 nm.

17. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a Young's modulus of about 13 to 20 Gpa.

18. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a Young's modulus of about 16 to 20 Gpa.

19. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a width of 340 to 1000 nm.

20. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a width of 340 to 700 nm.

21. (Amended) The bacterial cellulose of claim 1, wherein the microfibrils have [which has] a width of 340 to 600 nm.

The following claims are added to the application in the Preliminary Amendment attached hereto and as shown below:

22. (New) The bacterial cellulose of claim 1, wherein the microfibrils have a thickness of 2.5, 3, 6, or 9 nm.

23. (New) The bacterial cellulose of claim 1, wherein the ratio of the major axis to the minor axis of the microfibrils is about 28:1.0 to 1000:1.0

24. (New) The bacterial cellulose of claim 1, wherein the ratio of the major axis to the minor axis of the microfibrils is about 28:1.0 to 280:1.0.

25. (New) A bacterial cellulose produced by Acetobacter pasteurianus FERM BP-4176 which comprises microfibrils having a thickness of 1 to 9 nm and a width of 250 to 1000 nm.

26. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a width of 250 to 700 nm.

27. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a width of 250 to 600 nm.

28. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a width of 430 to 1000 nm.

29. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a width of 590 to 1000 nm.

30. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a width of 340 to 1000 nm.

31. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a width of 340 to 700 nm.

32. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a width of 340 to 600 nm.

33. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a Young's modulus of about 13 to 20 GPa.

34. (New) The bacterial cellulose of claim 25, wherein the microfibrils have a Young's modulus of about 16 to 20 Gpa.

35. (New) The bacterial cellulose of claim 25, wherein the ratio of the major axis to the minor axis of the microfibrils is about 28:1.0 to 1000:1.0.

36. (New) The bacterial cellulose of claim 25, wherein the ratio of the major axis to the minor axis of the microfibrils is about 28:1.0 to 280:1.0.

37. (New) The bacterial cellulose of claim 25, wherein the microfibrils are ribbon-shaped.

38. (New) A method of producing the bacterial cellulose of claim 25, which comprises culturing cellulose-producing bacteria which produce the bacterial cellulose extracellularly in a culture medium containing a cell division inhibitor, and recovering the bacterial cellulose produced in the culture medium.

39. (New) The method of claim 38, wherein the cell division inhibitor is selected from the group consisting of chloramphenicol, a protein synthesis inhibitor, an organic compound having β-lactamase inhibiting ability, nalidixic acid, promidic acid, pipemidic acid, oxolinic acid, ofloxacin and enoxacin.

40. (New) The method of claim 39, wherein the protein synthesis inhibitor is selected from the group consisting of tetracycline, puromycin and erythromycin.

41. (New) The method of claim 39, wherein the organic compound having β-lactamase inhibiting ability is thienamycin.

42. (New) The method of claim 38, wherein the concentration of the cell division inhibitor in the culture medium is 0.01 to 5 mM.

43. (New) The method of claim 38, wherein the bacteria are Acetobacter.

44. (New) The method of claim 38, wherein the bacteria are Acetobacter pasteurianus FERM BP-4176.--

Claim 1 has been amended to specify microfibrils having a thickness of 1 to 9 nm. Claims 2-3 and 15-21 have been amended for clarity. In addition, Claims 17 and 18 have been amended to recite "about" in reference to the Young's modulus recited therein. Newly added Claims 22-44 have been added to claim additional embodiments of the invention.

All errors corrected in this reissue application arose without any deceptive intention on the part of the applicant.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected herewith: Norman P. Oblon, Reg. No. 24,618; Marvin J. Spivak, Reg. No. 24,913; C. Irvin McClelland, Reg. No. 21,124; Gregory J. Maier, Reg. No. 25,599; Arthur I. Neustadt, Reg. No. 24,854; Richard D. Kelly, Reg. No. 27,757; James D. Hamilton, Reg. No. 28,421; Eckhard H. Kuesters, Reg. No. 28,870; Robert T. Pous, Reg. No. 29,099; Charles L. Gholz, Reg. No. 26,395; William E. Beaumont, Reg. No. 30,996; Jean-Paul Lavalleye, Reg. No. 31,451; Stephen G. Baxter, Reg. No. 32,884; Richard L. Treanor, Reg. No. 36,379; Steven P. Weihrouch, Reg. No. 32,829; John T. Goolkasian, Reg. No. 26,142; Richard L. Chinn, Reg. No. 34,305; Steven E. Lipman, Reg. No. 30,011; Carl E. Schlier, Reg. No. 34,426; James J. Kulbaski, Reg. No. 34,648; J. Derek Mason, Reg. No. 35,270; Surinder Sachar, Reg. No. 34,423; Jeffrey B. McIntyre, Reg. No. 36,867; Bradley D. Lytle, Reg. No. 40,073; Michael R. Casey, Reg. No. 40,294; William T. Enos,

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this declaration is directed.

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